Anatomy, Physiology and Reproduction in the Mare

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Factsheet

ORDER NO. 10-099 AGDEX460/30 DECEMBER 2010
(replaces OMAFRA Factsheet *Anatomy, Physiology and Reproduction in the Mare*, Order No. 88-060)

Horses have the potential for high reproductive performance. With an understanding of basic reproductive science, breeders can be better positioned to achieve their goals.

This Factsheet presents information on basic anatomy, physiology and management techniques that can assist in improving reproductive performance in the mare.

ESTROUS CYCLE

The estrous cycle in most mares starts to normalize in late April or early May until August — the normal breeding season for horses. During this time, the mare will have an estrous cycle of 21 days (±3 days). The estrous cycle is composed of two phases: the **estrous** phase (in heat) and the **diestrous** phase (out of heat). Estrus usually lasts for 6 days, but can be 4–10 days, depending on the mare. Diestrus is normally 15 days, but may vary from 12–18 days. From September through March, very few mares will cycle normally, so conception is more difficult to achieve during these months.

Ovulation, the release of the egg from the ovary, can occur at any time during the estrus phase. However, it normally occurs 24–48 hr before the end of the estrus period. Ideally, to maximize the chance of conception, breeding should occur within 12 hr of ovulation. Breeding or insemination of mares, starting on Day 2 or 3 of estrus and continuing every other day throughout the estrus, is a practical means of achieving satisfactory pregnancy rates.

SEASONALITY

The mare's first estrus phases of each year are often erratic and prolonged, during which time mares may be in heat for 20–30 days or more. During late March, April and May, most mares exhibit sexual receptivity, and from late April through August, most mares will cycle normally.

Few early estruses result in ovulation; thus it is not recommended to breed mares during this time without rectal palpation of the ovaries to determine follicular development.

The primary environmental factor causing mares to cycle normally is increased hours of light (photoperiod). Artificial lighting can be used to induce mares to cycle earlier in the year.

HORMONES

The estrous cycle is controlled by hormones (Figure 1). Hormones are chemical substances created by the body that control various bodily functions. This section describes some of the hormones involved in mare reproduction.

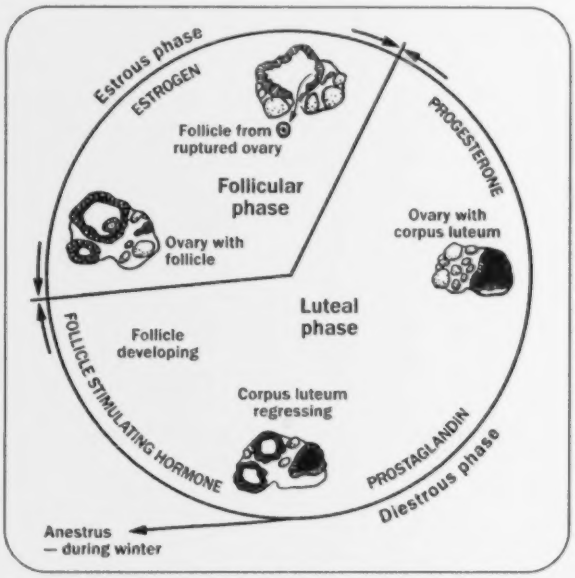

Figure 1. The estrous cycle.

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The pituitary gland is located at the base of the brain and produces follicle-stimulating hormone and luteinizing hormone. As spring approaches, the pituitary gland is stimulated by increased daylight to enhance follicle-stimulating hormone production. **Follicle-stimulating hormone** is released into the blood stream and travels to the ovaries to initiate development of a follicle containing an ovum. The developing follicle produces estrogens, which are released into the blood stream.

Estrogens have a number of functions in the body. When blood estrogen reaches a certain level, a surge of luteinizing hormone is released from the pituitary gland into the blood stream. Estrogens are responsible for the clinical signs of estrus and act on the oviducts, uterus and cervix to prepare the reproductive tract for pregnancy.

The surge of **luteinizing hormone** causes the follicle on the ovary to rupture, resulting in ovulation. As the follicle develops on the ovary, the ovum (egg) inside the follicle undergoes a number of changes to become capable of being fertilized by the sperm. The follicle contains a viscous fluid and when the follicular wall ruptures, this fluid flows out, carrying the ovum with it. The cavity left by the ruptured follicle becomes engorged with blood to form a corpus hemorrhagicum. The corpus hemorrhagicum luteinizes to form the corpus luteum, sometimes called the yellow body.

As the corpus luteum develops, it starts to produce **progesterone**, which influences the pituitary gland and reproductive tract. The feedback of progesterone via the blood stream inhibits the release of luteinizing hormone. Under the influence of progesterone, the mare will not show estrus. Progesterone function is to maintain the pregnancy by maintaining a uterine environment conducive to fetal development.

If the mare does not conceive, the corpus luteum remains functional for about 12–14 days. At this time, prostaglandin is released from the endometrium (inner lining of the uterus). **Prostaglandin** has a luteolytic effect — it acts on the corpus luteum via the bloodstream, causing it to regress. As the corpus luteum regresses, progesterone levels are reduced, resulting in the removal of the inhibition to luteinizing hormone secretion. The cycle starts over again.

If the mare conceives, hormonal activities are essentially the same as for the 12–14 days post-ovulation. Pregnancy recognition is stimulated by the action of the developing embryo migrating throughout the uterus; this action inhibits prostaglandin release. The result is an antiluteolytic effect, so the corpus luteum remains functional, progesterone levels are maintained and the pregnancy is continued.

Somewhere between Days 25 and 30 of gestation, the corpus luteum starts to regress, resulting in declining blood progesterone levels. If the progesterone level were to continue to decrease, the pregnancy would be terminated. However, a compensatory system has evolved that is unique to the mare. Between the 25th and 36th day of gestation, a girdle-like band of special cells develops around the fetal sac. On about Day 37 of gestation, this band detaches from the fetal membranes and invades the endometrial wall where these cells undergo tremendous enlargement and structural change. These cells clump to form the endometrial cups that secrete the hormone **equine chorionic gonadotropin**. Equine chorionic gonadotropin reaches the ovaries via the blood stream, stimulating secondary follicular development and luteinization. The secondary corpus luteum produces progesterone, as does the primary corpus luteum to Day 130 to 150 of gestation. From about Day 80 of pregnancy to term, adequate progesterone levels are maintained by special areas of the uterus and fetal membranes, to sustain the pregnancy.

The pregnant mare foals (parturition) at 340 days ±20, post-breeding. Initiation of parturition is very complex and not completely understood, but the fetus probably plays a role in initiating the process. Mechanical stimuli occur from distension of the uterus, which brings about an increased sensitivity of the uterus to the hormones estrogen and oxytocin. At the end of pregnancy, the uterus becomes active and the cervix dilates. **Oxytocin**, released by the pituitary gland, causes the muscles of the uterus to contract and expel the fetus (foal).

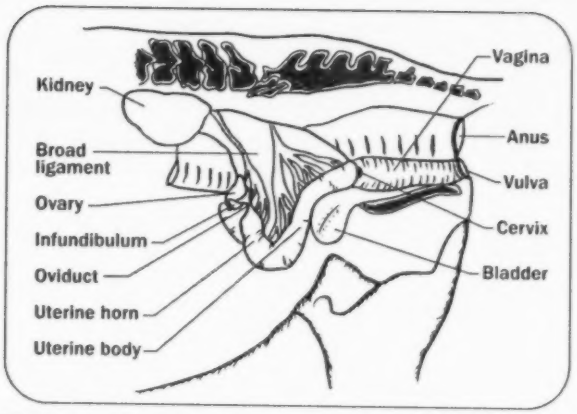

Figure 2. Sagittal view of the mare reproductive structures.

ANATOMY

Figures 2 and 3, respectively, depict sagittal and frontal views of the mare reproductive structures.

Broad ligament – a tough layer of fibrous tissue, containing blood vessels and nerves that serve to suspend the majority of the reproductive tract in the abdomen.

Cervix – a structure of approximately 10 cm (4 in.) in length between the vagina and the uterus. It is the "door to the uterus" and serves to maintain a sterile environment in the uterus. It relaxes when the mare is in heat and closes when not in heat or pregnant.

Infundibulum (fimbria) – the "catcher's mitt" structure at the ovarian end of the oviduct that picks up the ovum from the ovary at ovulation and transports it down into the oviduct.

Ovary – the primary sex organ of the mare. The ovary produces the ovum (egg) to be fertilized and serves as an endocrine gland producing the hormones estrogen and progesterone.

Oviduct – a long, convoluted tube extending from the infundibulum to the end of the uterine horns. It serves to transport sperm and ova to the site of fertilization in the upper one-third of the oviduct. The fertilized ovum is then transported to the uterus.

Uterus – a large uterine body, just anterior to the cervix, and two relatively short uterine horns that terminate in the oviduct. The uterus is where the majority of embryonic development and nourishment takes place. It also produces hormones and is the receptacle where semen is deposited during natural breeding.

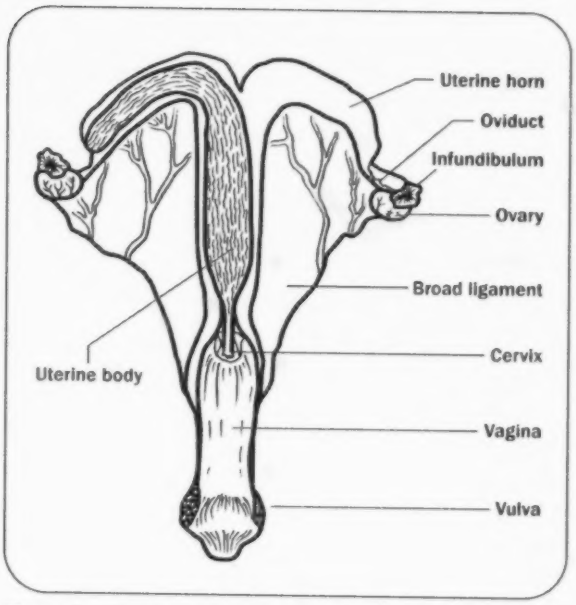

Figure 3. Frontal view of the mare reproductive structures.

Vagina – part of the birth canal that lies in the pelvic girdle between the vulva and the cervix.

Vulva – the external opening of the urogenital tract. It is part of the birth canal, and the area where urine is voided.

FERTILIZATION

The site of semen deposition in the mare is intra uterine (natural breeding) or the uterine body (artificial insemination). The muscular movements of the uterus and oviduct under the influence of estrogens are responsible for the migration of sperm to the oviduct.

When the follicle ruptures, it releases the ovum to be picked up by the fimbria (infundibulum). The fimbria funnels the ovum into the oviduct, where it comes in contact with the sperm. The union of the sperm and ovum forms the zygote, the beginning of an embryo. The embryo moves down the oviduct to the uterus. The time required to move the embryo from the site of fertilization into the uterus is about 6 days. By this time, the uterus has been under the influence of ovarian progesterone to create a suitable environment for fetal development and implantation.

Studies have shown that the embryo is relatively mobile within the uterus until Day 16 or 17, post-ovulation, because of the increased uterine tone, thickening of the uterine wall and enlargement of the vesicle. Movement throughout the uterus plays a role in the inhibition of the mare's estrous cycle.

Implantation occurs around Day 35 of gestation and placentation is initiated around Day 40 to Day 45. Up to this time, the fetal sac lies unattached in the lumen of the uterus.

AGE

Horses reach puberty between 12 and 18 months of age. It is therefore advisable to keep colts and fillies separate once they have reached 1 year of age. Even though young horses can reproduce, it is not advisable. Mares that are bred prior to maturity will require extra care and nutrition, especially during the period of lactation and last 3 months of pregnancy (due to the risk of dystocia), so that she and her foal will grow to their genetic potential.

Handle mares and performance test them prior to being bred, to assess their quality. If they perform well, the value of their foals increases.

MANAGEMENT

The mare's body condition will influence her reproductive performance. Mares that are moderately fleshy (slight crease down the back, fat covering the outlines of the ribs, noticeable amounts of fat along the sides of neck and withers, and soft fat deposited around the tail head) can be expected to:

- cycle earlier in the year
- have fewer cycles per conception
- have higher pregnancy rates
- maintain pregnancy more easily than thin mares

Therefore, preparing a mare for breeding with a feeding program of sufficient, nutritionally balanced, high-quality feed is recommended.

To detect a pregnancy, a transrectal ultrasound is recommended as early as 12–15 days, post-breeding. Also, a veterinarian can conduct a foal-time test between Day 45 and Day 120 to confirm pregnancy. A foal-time test is a serological test that detects the presence of equine chorionic gonadotropin; it does not guarantee that the mare is pregnant at the time of testing, but does indicate whether the mare was pregnant up to Day 37 of gestation. Knowing that a mare is not pregnant allows for planning additional breeding attempts.

Following recommended management practices and understanding the basic reproductive science of the mare will improve chances for reproductive health and success of the mare.

Updates to this Factsheet were coordinated by Tania Sendel, Veterinary Science and Policy Unit, OMAFRA, Guelph. The original Factsheet was authored by Dr. Bob Wright, Veterinarian-Disease Prevention Equine and Alternate Species, OMAFRA, retired.

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ISSN 1198-712X
Également disponible en français
(Commande n° 10-100)